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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/612,859	07/03/2003	Tse-Yao Huang	10112421	4400
34283	7590	10/28/2004	EXAMINER	
QUINTERO LAW OFFICE 1617 BROADWAY, 3RD FLOOR SANTA MONICA, CA 90404			LE, THAO P	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 10/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/612,859	Applicant(s) HUANG ET AL.	
	Examiner Thao P. Le	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>9/20/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. Information Disclosure Statement (IDS) filed on **09/20/04** and made of record.
The references cited on the PTOL 1449 form have been considered.
2. Claims 1-24 are pending.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-4, 7-8, 11-17, 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, U.S. Patent No. 5,933,749.

Regarding claims 1, 7 and 14, Lee discloses the method of forming shallow trench isolation with chamfered corners similar to claims 1, 7, 14, comprising:

forming a pad insulating layer 21, first mask layer (a photoresist layer and SiN layer 22);

patterning the mask, the insulating layer and first mask to form an opening exposing a portion of substrate;

etching the substrate using a the first mask to forming trench in the substrate (Figs. 2B-2C);

forming a second mask 24;

removing part of a second mask layer to expose the first mask layer result in the second mask layer having a tapered profile (Fig. 2B);

etching the second mask layer, the first mask layer, and the pad insulating layer and substrate along the tapered profile of the second mask layer to chamfer corners of the trench.

Still regarding claims 7, 14, Lee discloses the further steps of completely removing the second mask and forming liner oxide layer on the substrate, trench, and corners, and obviously the trench is filled with insulting layer and the insulating layer is then planarized to complete the trench isolation region.

Lee fails to disclose the step of forming a second mask prior forming the trench and using the second mask to etch the trench. Lee discloses the steps of using the first mask to form the trench and forming a second mask after the trench is formed. The second mask is formed to chamfer corners of the trench. It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the second mask at the same time with the first mask or after the trench is formed because the function of the second mask in this method would be the same, thus, yielding the same result, having a structure with a grading corner or chamfered corner in order to

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avoid charge accumulation and leakage current so that the reliability and productivity are improved.

Regarding claims 2-3, 16, Lee discloses the insulating layer is oxide and the first mask is silicon nitride 22.

Regarding claims 4, 17, it would have been well known in the art that the mask layer would have been either BPSG, PSG, BSG, or AsSG.

Regarding claims 11, 15, 20, it would have been well known in the art that either HDPCVD or LPCVD is widely used to form insulating layer and CVD is used to planarizing the insulating layer.

Regarding claims 8, 19, Lee discloses the chamfered corners of claim 7 wherein the trench region has a Y-shapered cross-section (Figs. 2C-2D).

Regarding claims 12-13, 21, Lee discloses forming a shield layer of oxide liner on the surface of the substrate, trench, and chamfered corners but doesn't state that the oxide liner is formed by thermal oxidation. It would have been well known in the art that thermal oxidation process is widely used to form liner oxide in the trench.

Regarding claim 22, Lee fails to disclose the step of removing the second mask and etching the first mask layer and pad oxide layer to remove a predetermined width thereof to expose a portion of the substrate adjacent to the trench. Lee discloses the steps of removing the first mask, and forming a second mask having a predetermined width thereof to expose a portion of the substrate adjacent to the trench (Fig. 2B). It would have been obvious to one having ordinary skill in the art at the time the invention

was made to form to form the second mask at the same time with the first mask, then remove the second mask, and etch the first mask or to use the first mask to form the trench and then forming a second having a predetermined width thereof to expose a portion of the substrate as disclosed in Lee because both technique would yield the same result, exposing a portion of the substrate adjacent to the trench and obtaining a structure with a grading corner or chamfered corner in order to avoid charge accumulation and leakage current.

5. Claims 5-6, 9-10, 18, 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, U.S. Patent No. 5,933,749, in view of Taiwan Patent Pub. No. 460974.

Regarding claims 5, 9-10, 23-24, Lee fails to disclose the step of etching the second mask to remove part of second mask layer and expose the first mask layer using wet etching such as HF/EG. Taiwan Patent Pub. No. 460974 discloses the step of removing hard mask using wet etching and etchant solution of HF/EG. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use wet etching and etchant solution of HF/EG when a method of removing portion of second mask to expose the underlying layer because HF/EG solution used in wet etching can etch the second mask at a faster rate than the underlying layer SiN 22 and thus the SiN layer 22 would not be affected by the wet etching.

Regarding claims 6 and 18, both Lee and Taiwan Patent Pub. No. 460974 do not disclose the use of APM as solution for wet etching. However, it would have been obvious to one having ordinary skill in the art to use APM because APM has similar function and characteristics as HF/EG.

6. Taiwan Patent No. 459339 also discloses similar method as recited in claims 1 and 14 of present application.

7. When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 571-272-1785. The examiner can normally be reached on M-T (7-6).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Thao P. Le'.

Thao P. Le
Examiner
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